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X-Ray Diagnosis of Renal Tuberculosis.—The recognition of early renal tuberculosis often depends on visualization of deformities in the minor calices, and the lack of detail too frequent in excretory roentgenography hampers its value; therefore, in renal tuberculosis retrograde urography is usually preferable; but, when ureteral catheterization is impossible or contraindicated, the difference in degree of visualization in the two kidneys may be of value. When one kidney has been catheterized and found normal but it is impossible to catheterize the other, excretory urography may be of great value. There are two points in which renal tuberculosis frequently originates: (1) the apex of a papilla as it projects into a minor calyx, and (2) the boundary zone at the base of a pyramid. With the first, there is usually early ulceration along the borders of the calices, apparent in the urogram as enlargement and irregularity, early extension into the pelvis, tuberculous pyelitis and ureteritis. The flaring distal extremity of the calyx is distorted, and its proximal tubular end narrowed and lengthened, or even obliterated. The ureter loses its undulating form, and there occurs a ureterectasis. When the focus is in the boundary zone, urographic findings are less characteristic, although with progressive necrosis calcification or other abnormality will often be present in the plain roentgenogram. As the disease progresses, the excretory urogram shows evidence of partial or complete obliteration of calices, even of the pelvis. *Review of roentgenographic findings:* Of 1,157 patients in whom renal tuberculosis was proved histologically, the roentgenographic findings were positive in slightly over 20 per cent. Small shadows in the kidney presented important characteristics, calcific areas being rough and irregular, whereas calculi are ordinarily discrete and smooth, and also more often in the pelvis or the calices. The kidney-shadow as a whole is commonly enlarged with superimposed circular shadows of deeper density, perhaps giving a "fleecy cloud" effect. The lesion may be localized or diffuse. The advent of excretory urography in 1929 has widened the scope and interest of the roentgenologist and necessitated more familiarity with the normal roentgenographic image. In differential diagnosis, changes resulting from pyogenic pyelonephrosis are most frequently confused with tuberculosis. Deformities in the latter are more commonly uniform. Nephrolithiasis, when associated with pyelonephritis or pyonephrosis with cortical abscesses, may simulate tuberculosis in its urographic manifestations. Carcinoma is not infrequently associated with calcification and necrosis. *Pathology and review of diagnostic methods:* The consensus of opinion is that renal tuberculosis is always secondary to involvement of the lungs, lymph nodes or bone. In over 30 per cent of this series there was evidence of pulmonary disease, mostly latent, and in slightly over 6 per

cent of bone lesions. Among 700 cases diagnosed clinically, 25 per cent were bilateral, and 45 per cent showed pulmonary involvement. Thirty years ago, renal tuberculosis was seldom recognized until its later stages; to-day it is suspected if dysuria persists over one or two months. With modern procedures, severe bladder ulceration and deformity (the end-results of neglect) are rarely encountered. In the vast majority of cases, the original infection is haematogenous, the bacillus passing through the capillary system to some part of the collecting system, and then by a retrograde process up the lymphatic structures to the cortex. It may remain for a long time unilateral. An early miliary type, which recovers spontaneously, must be recognized. The initial invasion probably consists of a shower of organisms involving minute scattered areas of tissue. Possibly anatomical factors favor its persistence in one kidney with localized destruction.—*The Value of Roentgen Rays in the Diagnosis of Renal Tuberculosis, C. G. Sutherland & W. F. Braasch, Tubercle, American Section, April, 1936, xvii, 309.*—(*A. P.*)

Tuberculous Meningitis.—Of special interest in tuberculous meningitis is the mode of spread, which may be by (1) contiguity (2) lymphogenous, (3) haematogenous, (4) autoinoculation and (5) secretions. The lymphogenous route is most typical, but the haematogenous is highly important. There may be progressive waves of such invasion. A miliary tuberculosis of the ventricular ependyma, with or without meningitis, is common; also, pinhead-sized nodules in the *septum pellucidum*, the cornua of the lateral ventricles and the recesses of the 4th ventricle. They are often ranged along the blood-vessels. *Association with tuberculous tumors of the brain:* These are often multiple and show a predilection for the cerebellum, base and basal ganglia. They are rarely solitary. They constitute (Aschoff) about 50 per cent of brain tumors in children and 14 per cent in adults, diminishing rapidly after maturity. *Association with pulmonary lesions:* Blacklock found generalized miliary lesions in 87 per cent of 148 cases of children with primary lung lesions, and cerebral lesions, meningitis or tuberculoma in 73.6 per cent. Scott, in a series of 225 children, found 103, or 45.3 per cent, to have intracranial tuberculosis, either meningitis, conglomerate tubercles, or both. Blacklock found generalized miliary tuberculosis commoner with thoracic lesions (71 per cent) than with abdominal (58 per cent). Also, Blacklock and Griffin found 241 cases of tuberculous meningitis (nearly 10 per cent) among 2,500 consecutive necropsies on children up to 13 years of age. In 74 per cent the primary site was thoracic. Recent official figures for Glasgow showed, of 1050 deaths from tuberculous meningitis, meningitis alone in 73 per cent, 14.4 per cent with pulmonary and meningeal lesions, and 11 per cent with nonpulmonary and meningeal lesions. MacGregor, Kirkpatrick and Craig stated that in most cases a primary site of infection elsewhere could be detected, and they believe that a preëxisting focus in the brain, meninges or subarachnoid space antedates the more generalized process. Sometimes, however, we are unable to discover any such primary focus, and there may be a question of what the French term *granulie primitive*. The most likely portal of entry here seems to be the nose and ethmoidal canals.—*Tuberculosis with Relation to Meningitis, Particularly as Regards Children, H. H. Scott, Tubercle, May, 1936, xvii, 348.*—(*A. P.*)

Cultures in Diagnosis of Tuberculous Meningitis.—A series of experiments was carried out to demonstrate the superiority of the culture method over animal inoculation in diagnosis. Loewenstein's medium, containing 1 per cent glycerine, and Petragnagi's medium, containing asparagin, were used. One-half cc. of cerebrospinal fluid was seeded on the culture media, which were sealed and placed in the incubator in a horizontal position. One hundred and six spinal fluids were examined in this manner. Fifty-two per cent did not show acid-fast bacilli upon direct examination. The following results were obtained from the cultures: Five cases remained negative, but these cases later failed to present clinical evidence of tuberculous meningitis. Ninety-four showed positive cultures of human tubercle bacilli. Seven showed eugonic bovine bacilli. The cultures therefore yielded one hundred per cent positive results. Culture tubes should be examined after eight days' incubation. Frequently, microcultures are found at this time, making possible presumptive diagnoses of tuberculous meningitis. Because of the simplicity, practicability, precision, and value of the time element, the cultural method for the diagnosis of tuberculous meningitis is recommended. Twenty-six of the spinal fluids, showing eugonic tubercle on culture, were inoculated simultaneously with the making of the culture into guinea pigs. The animals developed a slow infection, dying five to seven months later of generalized inoculation tuberculosis. The question arose as to whether the cerebrospinal fluid had a bactericidal effect on tubercle bacilli. In consequence, certain fluids were

put in the ice-box for fifteen to twenty days. Cultures made at varying intervals showed abundant growth, illustrating that the bactericidal power of cerebrospinal fluid is practically nil.—*Résultats et intérêt practique de l'ensemencement direct de 106 liquides céphalorachidiens dans les cas de méningite produite par des bacilles tuberculeux humains ou bovins, E. Lesné, A. Saenz, M. Fontes Magarao & L. Costil, Compt. Rend. Soc. Biol., January 4, 1936, cxxi, 7.—(M. T. W.)*

Prognosis with Collapse Therapy.—Although dealing with fewer cases, the experience at King Edward VIII Sanatorium agrees with that of Frimley Sanatorium in that when successful pneumothorax has been accomplished the expectation of life is increased by 10 years. Early diagnosis is the all-important factor in the prognosis of any case. Phrenic evulsion has been used with good results in cases of a soft, caseous lesion limited to the upper zone and cases of thin-walled cavities in the same position. Tuberculous empyema developing in pneumothorax cases is treated by pleural irrigation followed by complete thoracoplasty. Proper and adequate after-cure is important as regards prognosis and the first two years are the dangerous ones. The prognosis of collapse therapy depends a great deal on the selection of the cases and the careful attention to detail during the stage of active treatment.—*The Prognosis of Pulmonary Tuberculosis, with Special Reference to Collapse Therapy, G. S. Todd, J. State Med., July, 1936, xliv, 410.—(L. F. B.)*

Anaesthesia in Thoracic Surgery.—The maintainance of adequate anaesthesia, at the same time providing sufficient amounts of oxygen, has been one of the real problems in thoracic work. In general, all patients requiring chest surgery are poor risks from the anaesthetic standpoint. They are usually in poor physical condition, and it is well known that they also show a marked intolerance for slight degrees of anoxaemia. The absorbing surface of the lung is reduced, abnormal amounts of mucus and pathological secretions are present, there is a marked tendency to cough, and the position of the patient on the operating table interferes with the work of the anaesthetist. The danger of embarrassment to respiration and to the circulatory system, due to an open pneumothorax, is lessened by the use of the closed-inhalation type of anaesthesia. There is a difference in the management of anaesthesia in thoracic cases in the first few postoperative hours. The ideal anaesthesia should be: free from deleterious effect on the patient, either immediate or remote; nonirritating to the respiratory passages; rapid and pleasant of induction without an excitement stage or the initiation of coughing. The anaesthesia should give quiet but sufficiently deep respiratory movements during the operative procedure and should be at all times under direct control of the anaesthetist. An anaesthetic action should cease when its administration is stopped, with rapid return of consciousness and the cough-reflex. Intrapulmonic pressures should be at all times under the control of the anaesthetist. The anaesthetic mixture should, if possible, be free from an explosive hazard. Adequate facilities for aspiration of material from the respiratory passages should be available. Avertin is probably most commonly used, but in our experience it is unsatisfactory because there is frequently marked lowering of the blood-pressure, and a definite depression of the respiration and cough-reflex several hours after it is administered. The commendable features of nitrous oxide are overshadowed by its great failing, the inability to give with it sufficient amounts of oxygen. Ethylene is somewhat better in this respect than nitrous oxide, and the mixtures usually used in anaesthesia are outside the explosive range. The obvious objection to ether is irritation of the mucous membranes. Acetylene has been used considerably in Europe, and we have had no experience in its use, but it requires more cumbersome apparatus and is highly explosive. Cyclopropane, or trimethylene, we feel, at the present time, to be the most satisfacory agent. It is capable of giving a depth of anaesthesia approaching that of ether in concentration of 20 per cent or less. It has been administered to patients with one-fourth their estimated normal vital capacity. Quiet, shallow, respiratory movements are produced, and recovery is rapid, usually in from three to ten minutes. Nausea and vomiting occur in the first three minutes in about one-fourth of the patients. It has the disadvantage of being inflammable. It is not a respiratory stimulant, so that preoperative medication of a respiratory depressed nature should be used in much smaller dosage.—*Anesthesia in Thoracic Surgery, V. H. Eversole & R. H. Overholt, J. Thorac. Surg., June, 1936, v, 510.—(L. F. B.)*

Treatment of Bilateral Pulmonary Tuberculosis with Cavity.—The indications for operative procedures as formulated by Jessen are much too vague and indefinite to advance the problem of management of bilateral cases. A firmer groundwork is represented by the pathological physiology, mechanics and biology of tuberculous cavi-

ties. Although tuberculosis may be a general disease, in at least 50 per cent of our cases it behaves as a strictly pulmonary disease. The conception that the closure is due to narrowing and obliteration of their communicating bronchi gives us an explanation of the action of collapse treatment and points the direction our efforts should follow. No bilateral case should be considered hopeless as long as one-fourth of the lungs is free from disease. Indications for collapse therapy formulated by us thus far are based exclusively upon the topographical distribution of cavities. With extrapulmonary disease, operability is determined as in unilateral cases, and the extrapulmonary lesion is treated independently of the pulmonary lesion. In cases with cavitation on one side and a suspicious lesion on the other, if pneumothorax is impossible, thoracoplasty is indicated. If no cavity is found in the better lung, after careful study, and diagnostic pneumothorax is necessary, the operation should be carried out. If a cavity is found by diagnostic pneumothorax, in the better lung, the pneumothorax is maintained during the thoracoplasty on the diseased side. When bilateral apical cavities are present, bilateral pneumothorax should be attempted, beginning on the more affected side. Adhesions preventing successful selective collapse should be cut by closed pneumolysis without delay. Phrenicectomies and phrenicotomies are opposed. If pneumothorax is not possible on one side, thoracoplasty should be done on it after the opposite lung is satisfactorily collapsed selectively by pneumothorax. When pneumothorax is impossible on either side, or adhesions cannot be cut successfully, a bilateral thoracoplasty should be done. When cavitation is present in the upper lobe of one side and there is an extensive ulcerative lesion in the other lung, bilateral pneumothorax is attempted beginning on the more diseased lung. If it is successful or successfully completed by pneumolysis on one side, thoracoplasty is done on the other side. The decision to perform thoracoplasty in these cases depends upon the amount of healthy and adequately functioning lung present. In cases of disease in the upper lobe of one lung and the lower lobe of the other, it is desirable to control the basal lesion before thoracoplasty is done for the apical lesion if pneumothorax there is unsuccessful. In these cases phrenic surgery may be indicated. In advanced bilateral ulcerative lesions, reasonably no surgical collapse should be attempted. The majority of cases failed, but there were a number of spectacular results. There are a number of cases in which thoracoplasty did not seem feasible. In these, apicolysis with plombage was carried out either temporarily or permanently. There are numerous and dangerous postoperative complications. Massive spread of the disease to the lower lobe or contralateral lung has been less numerous and less severe following thoracoplasty since selective collapse has been maintained with pneumothorax on the contralateral lung. Transient massive infiltration, probably allergic in nature, of the contralateral lung, may occur. Two cases have been successfully treated in Drinker's Respirator. Spontaneous pneumothorax of the contralateral lung occurred 22 times in 16 patients. Four died. Massive atelectasis from intratracheal aspiration is most urgent and requires immediate aspiration of the secretions. Pleural effusions occur in about 60 per cent of cases following closed pneumolysis. The 238 cases studied may be divided into 3 groups. Group 1 contains 144 patients with unilateral or bilateral pneumothorax on whom closed pneumolysis was done on one or both sides. In only 25 could pneumolysis not be done: group 2, 87 patients with pneumothorax on one side and thoracoplasty on the other: and group 3, 7 patients with bilateral thoracoplasty. The results were tabulated according to negative sputum, positive sputum and death. Negative sputum means negative findings on direct and concentrated smears for over four months. Cultures or inoculations were considered too sensitive. Of the 144 cases in group 1, 50 were negative, 77 positive, and 17 died: 72 of these had pneumothorax with unilateral pneumolysis; and 13 are negative, 49 positive and 10 died. Thirty-nine of the 144 had bilateral pneumothorax with unilateral pneumolysis, and 24 are negative, 15 positive and none dead. Eight had bilateral pneumothorax with bilateral pneumolysis, and 5 are negative, 2 positive and 1 died. Of the 25 cases having unilateral or bilateral pneumothorax but in which adhesions could not be cut, 7 are negative, 18 positive and 4 died. In group 2, 42 of the 87 cases are negative, 29 positive and 16 died. Of the 7 cases in group 3, having bilateral thoracoplasty, 4 are negative, 3 positive and none dead.—*Management of Bilateral Cavernous Pulmonary Tuberculosis, P. N. Coryllos & G. G. Ornstein, J. Thorac. Surg., April, 1936, v, 337.*—(*L. F. B.*)

Muscle Plombage for Tuberculous Cavities.—The operative procedure advocated by deWinter was found suitable for the treatment of patients with pulmonary tuberculosis and large cavities which could not be collapsed by pneumothorax and whose outlook for closure by thorocoplasty is rather hopeless. In this operation the

major, and sometimes the minor, pectoral muscle is freed from the ribs and is pushed into the thoracic cavity through an opening made by the resection of the second rib. This is followed by thoracoplasty. Six cases with large cavities were treated in this manner with satisfactory results. Two of these cases are briefly reported.—*Über die gestielte Pectoralismuskelplombe nach "de winter" (Brügge) zur behandlung grosskavernöser Lungentuberkulose, F. Häberlin, Beitr. Klin. Tuberk., May, 1936, lxxviii, 19.—(M. P.)*

Artificial Pneumothorax and Contralateral Cavities.—In 4 cases of pulmonary tuberculosis with bilateral cavitation the institution of unilateral pneumothorax influenced favorably the contralateral cavities. In two cases the contralateral cavities closed completely and permanently. In one case closure of the contralateral cavity was only partial, while in the fourth case the contralateral cavity, a large thin-walled affair, closed within two weeks of the initiation of the pneumothorax only to reappear in its full extent by the end of a year. The most important factor in producing this favorable effect on contralateral cavities is a purely mechanical one. When pneumothorax is first instituted the mediastinum is displaced to a greater or less degree towards the opposite side, and any change in intrathoracic pressure produced on one side is transmitted equally to the other. Only when the mediastinum ceases to shift further will the pressure on the contralateral side begin to be less than that on the side on which the pneumothorax is being induced. Another mechanical factor that might favor closure of cavities on the contralateral side is the decreased ventilation of the contralateral lung. There are two other factors that have been postulated as acting on the contralateral lesions. First, there is the favorable effect of pneumothorax on the lesions of the homolateral side, which, acting in a general way on the patient's general physical state, might promote healing on the opposite side. Also, some workers have postulated a favorable immune reaction due to the absorption of products from the collapsed lung. There are probably no circulatory factors of significance. The type of lesion that responds favorably to contralateral pneumothorax is the well-defined cavity, with a minimum of activity in the adjacent lung tissue. Well-defined contralateral cavities are of themselves no contraindication to unilateral pneumothorax. In some instances they may be influenced favorably by the procedure. Because the most important factor acting on the contralateral lesion is a purely mechanical one, as indicated above, there is no reason to expect that these lesions will respond as well as they would were a pneumothorax induced on that side.—*Les cavernes contralaterales constituent-elles une contre-indication au pneumothorax artificiel? P. Pruvost, M. Leblanc & M. Petraud, Arch. Med. Chir. l'App. Resp., 1936, xi, 141.—(C. L. D.)*

Increasing Importance of Artificial Pneumothorax.—To-day many institutions report 75 per cent or more of their tuberculous patients as receiving artificial pneumothorax. This is in striking contrast to the usual 5 to 10 per cent of five to ten years ago. It is the most effective single means for the immediate control of the tuberculous toxaemia that always accompanies active phases of the disease. With toxaemia eliminated, the patient gains in weight and strength, and within a relatively short time is able to resume daily work without prejudicing his health. To many it offers the one solution of the underlying social and economic problems that are so intimately associated with tuberculosis. It improves the ultimate prognosis. The induced pneumothorax can keep a diseased lung at rest indefinitely, and this accounts for the relatively large percentage of cures among such patients. A patient with moderately advanced tuberculosis, treated with pneumothorax, has a chance for ultimate recovery six times as great as one without pneumothorax. Artificial pneumothorax is a public-health measure of the first magnitude. It is the surest and quickest method for eliminating tubercle bacilli from the sputum, and, with the establishment of field pneumothorax clinics, it has become the solution to the problem of inadequate hospital facilities. The complications of pneumothorax therapy, such as air embolism, pleural shock, pleural effusions (transudate, tuberculous pleurisy and tuberculous empyema), spontaneous pneumothorax, contralateral spread, etc., are quite real, but they are perhaps overemphasized. They are not more serious than the complications of passive treatment. The development of selective and simultaneous bilateral pneumothorax has widened the indications for pneumothorax therapy and the contraindications have been correspondingly narrowed to relatively few conditions.—*The Increasing Importance of Pneumothorax Therapy in Pulmonary Tuberculosis, J. W. Cutler, J. Am. M. Assn., April 18, 1936, cvi, 1366.—(G. L. L.)*

Complications of Artificial Pneumothorax.—Baum has attempted to collect

statistical data from questionnaires sent all over the world to leading phthisiologists, from whom he received 82 replies. Some of the principal questions covered were as follows: *1: Fatal Accidents: incidence, causes and avoidance:* Estimates ranged from zero to 2 per cent, the first four causes assigned being (1) air embolism, (2) spontaneous pneumothorax, (3) pleural shock, (4) cardiac failure. Over 50 per cent of those responding stated they could not always be avoided, but as many as 20 per cent thought they could, 12 per cent without qualifications. *2: Fluid-formation: incidence, prevention and treatment:* Of 72 estimates given, the range was from zero to 100 per cent, with a mean of about 50 per cent if adhesions existed, 33 per cent if not. The majority considered them unavoidable, with or without qualification, but better selection of cases, avoidance of high pressure and smaller refills were mentioned as of preventive value. The majority practised withdrawal of the fluid (some with qualifications). *3: Empyemas and their treatment:* There was a variety of answers, the majority favoring aspiration, a considerable number irrigation or thoracoplasty, and a smaller number oleothorax. Of 12 replying definitely as to the prognosis of uncomplicated empyema, 8 thought recovery rare. *4: Pneumothorax in early cases:* About 50 per cent responding believed that most of the above complications were avoidable, but 25 per cent held a contrary view, the others being guarded. As to the collapse therapy of early infiltrations, about 60 per cent were more or less in favor, about 20 per cent opposed and 10 per cent favored preliminary observation. There was much diversity of opinion on the discontinuance of treatment in such cases, and many refused to generalize. *Comments:* Hedblom's principles should be the guiding indications in treating tuberculous empyema, which is always serious. In sterile (nonpyogenic) cases complicating active pulmonary disease, aspiration is the treatment of first choice, replacing the pus by filtered air and supplementing with heliotherapy. Hedblom suggests trying this for six months to a year before performing thoracoplasty, but Baum would extend this to two to three years and also give liver extract. Open drainage is a bad mistake. When surgery is required the pleural sac is obliterated as soon as possible. As to the occurrence of accidents during administration, these are certainly more frequent in old long-standing cases than when there is normal lung tissue. The mechanical factor in early destructive lesions is winning more appreciation. It is unpardonable to watch a cavity gradually increase without trying collapse therapy. However, it is also a mistake to collapse an early sputum-negative retrogressive infiltration of the lung in which all indications are favorable, unless it gives rise to bleeding. In the border-line cases the right decision can be reached in sanatoria at medical-staff conferences. It is preferable that the initial induction be done by experienced men but senior medical students and internes should receive practical technical instruction.—*A Questionnaire on Complications Following Artificial Pneumothorax in Pulmonary Tuberculosis and their Prevention by Collapse Therapy of Early Diagnosed Cases, F. Baum, Tubercle, American Section, February, 1936, xvii, 212.*—(*A. P.*)

Pleural Effusion in Artificial Pneumothorax.—This is the commonest and most upsetting complication met with in the course of pneumothorax treatment of pulmonary tuberculosis. Although it has been claimed that benefit may ensue, due to combined mechanical and serological effects, Rosenthal has never observed any clearly defined benefit, and there are 3 definitely undesirable sequelae: 1. Marked pleural thickening, preventing later reëxpansion of the lung—"opaque pneumothorax." 2. Premature obliteration of the pneumothorax space by fibrinous organization of the fluid. 3. Development of an empyema. At best, the fluid merely lessens the frequency of refills, at worst it is the precursor of a tuberculous pyothorax. *Incidence:* The reported literature shows wide discrepancies, some observers having deliberately excluded cases with very small effusions. Burrell's figures on a series of 309 cases show an incidence of 42 per cent in which fluid covered the diaphragm and was observed for at least a week; but he considers that practically all cases develop at least a small transient effusion during their course. In another series of 500 cases 35 per cent were noted to have effusion of which a little over one-third became purulent. Dumarest and Brette report 70 per cent effusions in 265 cases, Saugman 67 per cent in 238 cases, Rist and Naveau 52 per cent, excluding small transient effusions. It is a generally accepted opinion that when pyothorax does not supervene the presence of fluid ordinarily does not have a bad effect. Rosenthal here reviews 54 patients who received artificial pneumothorax (out of 629 admitted) at the Gresswell Sanatorium from April 1933 to March 1935 and divides them into groups as follows: 1. No effusion—13 (24 per cent). 2. Small "puddle" only—18 (33 per cent). 3. Covering diaphragm only—7 (13 per cent). 4. Larger serous or serofibrinous—9 (16 per cent). 5. Larger seropurulent or purulent—7 (13

per cent). This gives a total of 76 per cent with some effusion. The presence of adhesions was also investigated, and of febrile reaction. Adhesions were present in 100 per cent of those with large effusions and 69 per cent of those with no fluid. Febrile reaction occurred in 85 per cent with large purulent or seropurulent effusions and 66 per cent with large serous effusions; only in a small minority of the others. The time of appearance of the effusion was quite variable. The only deaths were in 2 of the 7 cases of tuberculous empyema. *Possible Aetiological Factors:* 1. Repeated Puncture of Parietal Pleura (traumatic irritation).—Burrell considers this unimportant and states that thoracoscopic examination of the pleura showed no evidence of inflammation about the site of punctures. Nevertheless, some patients experience local discomfort and slight fever after each refill. 2. Introduction of a Foreign Body (Gas) into Pleural Space.—That some pleural reaction follows is evidenced by (1) gradual occurrence of pleural thickening, detectable as increased resistance to the passage of the needle; (2) increased rigidity of the mediastinum: It is generally agreed that the nature of the gas has no effect and likewise the rate of flow, while warming it is valueless. 3. High Intrapleural Pressure.—This tends to stretch adhesions present and is sometimes followed by not only homolateral but contralateral effusion. 4. Rupture of Adhesions.—Fine bands may break with little or no effect, especially during coughing or sneezing, on the other hand, severe pleural shock may occur, with later formation of an effusion. Rupture of firm bands based on the lung may expose a subpleural focus; or even a cavity. A rise of intrapleural pressure often precedes the appearance of effusion. 5. Spontaneous Pneumothorax.—This is probably a not infrequent cause of effusion; if a large rent is made in the lung the effects may be serious and bronchopleural fistula with empyema result. 6. Severing of Adhesions, as in the Jacobaeus operation. *Tuberculous Infection and Effusion:* That effusions are the result of tuberculous pleurisy is accepted by Burrell, Davies and others. They are rare in nontuberculous pneumothorax, especially experimental, and the cytology is that of exudate. The acuteness of the infection is more important than its extent. *Treatment:* Other than prophylactic technical precautions and symptomatic measures, calcium therapy has been suggested, without much real basis, chiefly by injection. Rosenthal has not found it effective. Cases for pneumothorax should be carefully selected, positive pressures avoided and the method be abandoned if collapse is unsatisfactory before complications occur. In the presence of fluid, if the amount is small and not disturbing, refills should be carefully continued possibly with occasional aspiration to note changes in character. If effusions are large, aspiration and air replacement should be done. If empyema develops, treatment is surgical. If collapse is poor, it should be abandoned for other measures.—*The Incidence of Pleural Effusion in Artificial Pneumothorax, D. B. Rosenthal, British M. J., January 18, 1936, No. 3915, 95.*—(*A. P.*)

Termination of Artificial Pneumothorax.—This is a most difficult problem. Only such cases are considered in which a satisfactory collapse has been obtained and maintained, with freedom from symptoms. Most of the earlier cases were not treated long enough and relapses were numerous. Now one seldom sees a case in which the total period of satisfactory pneumothorax is less than three years; and Rist, in 1930, advised delaying complete reëxpansion until the fifth year. During the past five years in the United States there has been an enormous increase in the number of cases as treated, and, with so many more physicians equipped to give pneumothorax, patients seldom have to travel far or remain at sanatoria for refills. In 1934, about 25 per cent of patients with pulmonary tuberculosis, or 16,401, received initial treatment among those admitted to 494 institutions; but today one encounters far too many whose disease has recurred after completion of pneumothorax treatment and these relapses are more dangerous than the original lesion. The longer the treatment, the fewer the relapses after reëxpansion. *Factors affecting allowing reëxpansion: 1: Extent and nature of the original lesion:* When there has been a large area of excavation originally, a phrenicectomy or thoracoplasty may be necessary and probably such cases, especially if intermittently sputum-positive, should have treatment kept up indefinitely. *2: Behavior of the lesion as shown by X-ray during reëxpansion:* A complete X-ray serial of each case should be in the hands of the current operator, as a tuberculous lesion often undergoes frequent radical changes during pneumothorax treatment. The most important change to look for roentgenographically is a reappearance of excavation, which will indicate immediate resumption of refills in order to close the cavity. Pleural thickening will considerably obscure lung detail. Of particular concern are lesions which by serial X-ray show little evidence of either resolution, calcification or fibrosis. If these have not healed under pneumothorax they certainly will not do so after reëxpansion and

may readily proceed to caseation, excavation or progression in the absence of collapse. *3: Age and occupation:* The younger the patient, the more reason for prolonging treatment. Statistics show relapses following reëxpansion to be more frequent in the younger age-groups. Patients in occupations involving much physical exertion should be encouraged to find easier jobs. In the young such a change is not usually difficult. Those who must return to hard manual labor should have treatment continued considerably longer than other patients and often indefinitely. The same thing is true for those whose economic status is poor and where there are many home contacts. *4: Pregnancy:* When there has been much original lung destruction, pregnancy is not advised; when less, it may be considered safe, provided pneumothorax is continued for at least a year after term; when moderate, the patient may choose between having a baby during the fourth year of pneumothorax, following satisfactory collapse and negative sputum, or continuing treatment another year, or allowing reëxpansion during the fourth year, and waiting three years before getting pregnant. *Technique of reëxpansion and testing:* The partially reëxpanded lung is first allowed to expand further, leaving perhaps only a 10 per cent pneumothorax before refill, and collapse thus maintained four to six months, with not over 20 per cent collapse after refill. The site of the original lesion is thus partially reëxpanded throughout. The patient is instructed to rehearse any extra work or exercise contemplated after ceasing treatment. If there is no roentgenographic change and the sputum remains negative, refills are stopped and the pleural space allowed to become obliterated. Careful sputum check-ups are most important. Recently, at New York Hospital and Cornell University Medical College, it has been decided to drop direct-smear examinations from the routine search for tubercle bacilli. Woolley has shown that at least 5,000 bacilli per cc. of material must be present in a smear to be microscopically detectable. Two months before the final refill is due, a three-day specimen of sputum is inoculated into a guinea pig and, if the animal develops tuberculosis, treatment of the patient is continued unless the bacilli may have come from the contralateral lung. Every patient ought to be given the benefit of such a precautionary test.—*When Should Refills be Stopped? J. C. Dundee, British J. Tuberc., April, 1936, xxx, 55.*—(*A. P.*)

Artificial Pneumothorax in Experimental Lobar Pneumonia.—Lobar pneumonia was produced in 36 dogs with type-I pneumococcus by a modified Robertson technique. Daily blood cultures were made, and daily observations on serum-agglutination, mouse-protection tests, and estimations of the phagocytic power of the whole blood were made simultaneously. In the last test, the Boerner and Mudd's technique was used. Its results corresponded with those of the other two, and this test seemed the most delicate. In dogs untreated by artificial pneumothorax the phagocytosis-promoting antibodies were negligible for the first few days following infection. The index remained below 50 per cent the next few days, and rose gradually afterward. Between the tenth and fourteenth days it rose abruptly to nearly 100 per cent, and remained there. Treated dogs showed similar curves. Mention is made of uncompleted work of Hopkins and Griffith, which indicates that radiographically opaque particulate matter injected into the parenchyma of the lungs of uninfected rats spreads less extensively, and appears in smaller amounts in the lymphatics of the parietal pleura and of the diaphragm on the side where artificial pneumothorax is induced. It was found that 70 per cent of the dogs given 0.1 cc. of sedimented pneumococci, type I, developed bacteraemia; 75 per cent of those given 0.125 cc.; 92 per cent of those given 0.2 cc.; and 100 per cent of those given 0.25 cc. Thirteen dogs which developed bacteraemia were treated. Of these, seven recovered and six died. In most animals with bacteraemia pneumothorax appeared to produce a coincident diminution in the number of colonies present in the blood cultures. Of two treated dogs that recovered, one had a blood culture with 32 colonies and another with 62 colonies per cc. Four of the treated dogs that died had an overwhelming invasion of the blood-stream, and were found at autopsy to have both lungs involved. One treated dog developed bacteraemia the day following the pneumothorax. Another, with 6 colonies per cc. on the culture taken the day pneumothorax was instituted, developed an overwhelming invasion of the blood-stream during the next twenty-four hours and died. Of the 10 dogs which survived forty-eight hours, in the untreated group six recovered and four died. No untreated dog with a culture showing more than 7 colonies per cc. survived. Further work must be done before a defintite statement can be made as to the effect of artificial pneumothorax on pneumococcic bacteraemia. —*Further Data on Artificial Pneumothorax in Experimental Lobar Pneumonia, L. M. Lieberman & S. S. Leopold, Arch. Int. Med., March, 1936, lvii, 566.*—(*C. L. D.*)

Artificial Pneumothorax in Experimental Lobar Pneumonia.—Healthy dogs, weighing 8 to 12 kg., were given pneumonia by spraying 1 cc. of sedimented pneumococci, types I, II and III, derived from 20 to 30 cc. of an eighteen- to twenty-four-hour broth-culture over the mouth of the lower-lobe bronchus. Blood cultures were made twenty-four hours following the insufflation, and cultures were also made of heart's blood at autopsy. If either or both were positive, the dog was said to have had bacteraemia. Pneumothorax was induced by injecting, under manometric control, 200 to 350 cc. of air in the 5th interspace, posterior axillary line. Of the 40 dogs used in the experiment, twenty-six were classed as very sick or toxic. Pneumothorax was given to fifteen of these. Of the 14 nontoxic animals, two received pneumothorax. The mortality rate was found to parallel closely the incidence of bacteraemia, regardless of whether or not pneumothorax was used. Pneumothorax-treated dogs in neither group did better than the untreated ones. No clinical "crises" were observed following the pneumothorax, and 60 per cent of the 15 toxic animals treated appeared worse or unchanged by the third day following institution of the pneumothorax. This was in contrast to 73 per cent of 8 equally toxic untreated animals which showed definite signs of improvement at that time. Roentgenograms showed that bilateral pneumothorax was the rule, the gases diffusing to the other side. It was found that in dogs whose mediastinums had been thickened by a subacute pleurisy induced by inclosing the lower lobe of the lung in a rubber balloon, the artificial pneumothorax remained unilateral. The authors found it difficult to see how pneumothorax could by mechanical means prevent or even diminish bacteraemia. They feel that the procedure would tend to impair drainage, and promote bronchial obstruction in both the diseased and uninvolved lungs. Artificial pneumothorax may relieve pain, but it does not influence the crisis in lobar pneumonia.—*Pneumothorax Therapy in Experimental Lobar Pneumonia in the Dog, G. L. Birnbaum & P. N. Coryllos, Arch. Int. Med., March, 1936, lvii, 610.*—(*C. L. D.*)

Oleothorax for Prevention of Effusions.—The intrapleural injection of small amounts of oil has been recommended repeatedly for the prevention of pleural effusions in patients treated with pneumothorax. In 100 cases, 2 cc. of sterile olive oil was injected during one of the first inflations. In some patients this was followed by painful and febrile reactions. Of these 100 patients, 23 developed clinically significant amounts of effusion. Out of 100 control cases with pneumothorax but without oil injections, 27 developed such effusions.—*Über prophylaktische Ölinstallation zur Verhinderung von Pneumothoraxexsudaten, I. Laurin, Beitr. Klin. Tuberk., May, 1936, lxxxviii, 59.*—(*M. P.*)

"Medicated Thorax" in Artificial Pneumothorax.—The author suggests that, together with artificial pneumothorax, a spray of solutions of trypaflavine, camphor, menthol, thymol or eucalyptus be introduced into the pleural cavity. It must be assumed that the air in the pleural cavity following artificial pneumothorax is in continuous contact with the infected organism by means of gaseous exchange. This can be proved by observing the air exhaled following the introduction of odorous substances into the pleura. By the intrapleural application of proper substances the author expects a *sterilisatio magna* of the involved lung. With special equipment, the treatment can easily be administered. Without giving details of treated cases, the author claims that pleural effusions fail to develop in artificial pneumothorax, and the parenchymal tuberculosis involvement heals more rapidly. —*Der Medikothorax, eine neue Pneumothorax-Behandlungsmethode, W. Müller, Schweiz. mediz. Wchnschr., February 29, 1936, lxvi, 225.*—(*F. G. K.*)

Anti-Adhesion Artificial-Pneumothorax Needle.—Because pulmonary tuberculosis commonly develops from an initial lesion at the periphery, an adhesive pleuritis with partial obliteration of the space is very common and many cases that could be benefited by artificial pneumothorax are abandoned after futile efforts. The needle described has a blunt stylet which can be carried about three-eighths of an inch beyond the end of the needle, with a double lock at its base. With the stylet in place the calibre of the needle barrel allows the passage of air through the needle and into the chest cavity. It permits of a high percentage of successful cases with lessened liability to trauma.—*A New Instrument—an Anti-Adhesion Pneumothorax Needle, C. Floyd, New England J. M., April 16, 1936, ccxiv, 785.*—(*A. P.*)

Cauterization of Adhesions in Bilateral Artificial Pneumothorax.—Severe respiratory difficulties sometimes occur during the division of adhesions, especially in bilateral pneumothorax. A case is described in detail, in which this occurred, and the difficulty was overcome in a simple manner by the use of a cupping glass to create suc-

tion.—*Technical Detail in Adherence Cauterization in Bilateral Pneumothorax, H. C. Jacobaeus, Acta Tuberc. Scandinav., Fasc. 4, December, 1935, ix, 375.*—(*F. B. S.*)

Adhesions in Artificial Pneumothorax on Oblique Roentgenograms.—Both roentgenography and roentgenoscopy are necessary in studying pleural adhesions. Stereoscopic films may be of little value because adhesions which are parallel to the main beam of the roentgen ray are not visualized or usually they are lost in the shadows cast by the collapsed lung. Posteroanterior views should be supplemented by oblique films. Anterior and posterior (45° rotation) positions are taken on the same 14″ x 17″ film by alternately covering one-half with a lead screen. The exposure technique is the same as for the usual posteroanterior positions except that the time is doubled. The tube is centered over the unprotected half of the film. In the anterior oblique position the arm on the side filmed should be rotated inward and the point of the shoulder brought as far forward as possible, and in the posterior oblique this forearm should be placed across the small of the back to throw the humerus out of the picture. Exposures are made on full expiration. Adhesions which are seen in all three views will appear longest in the film where the main beam was most perpendicular to the adhesion.—*Oblique Films for the Study of Adhesions in Artificial Pneumothorax, R. T. Ellison, Am. J. Roentgenol. & Rad. Ther., November, 1935, xxxiv, 592.*—(*E. M. J.*)

Thoracoscopy.—*Types of thoracoscope: 1:* Those without an optical system, with an ordinary cannula into which is introduced a lamp-carrier and a cautery. *2:* Those with optical instruments which give different degrees of deviation of the rays, necessitating a second puncture for the cautery. *3:* Combined thoracoscopes which allow simultaneous orientation and cauterization. Head and Rice use the cannula of an ordinary trocar with a bronchoscopic lamp-carrier for orientation and an ordinary cautery for liberation. They have also devised a lamp carrier with a diathermic cautery. Masher's thoracoscope consists of a cannula with a small electric lamp on a bayonet-like shaft. This lamp, after passing through, makes room for the optical system and avoids reflection. Singer's thoracoscope has an enlarging lens, lamp and diathermic cautery. Jacobaeus's instrument contains a total reflecting prism which deviates the rays to 90°. Unverricht's is similar, with a larger field of vision. These latter types allow study of the adhesions posteriorly, also retrograde and perpendicular vision, and need be only slightly inclined for complete examination of the pleural cavity. There are some disadvantages, such as difficulty of orientation because of transposition of the observation level. Chandler's thoracoscope has an optical of deviation of 30° and Kalk's 45°; Kremer's has direct vision, permitting direct examination of adhesions, and it gives an axial view. It is a straight tube containing a prism, an ocular with direct vision, and a kind of cannula, with a bayonet-like distal end supporting a small lamp. It does not permit observation of the posterior aspect of an adhesion nor can it be used for a very small pneumothorax, but it is simpler to operate. *Methods of cauterization: 1: Galvanic:* This is the cheapest and most common. The cauteries vary in shape, Unverricht using one to fit the curvature of the thorax, and Jacobaeus a hooked one to hook adhesions and avoid wounding the lung. The current is furnished by a transformer provided with graduated rheostats. Spare sterilized lamps should be on hand. Kremer's combined thoracoscope has a curved fixed galvanic cautery at the end of a 9-mm.-wide cannula, into which is introduced a lamp mounted on a shaft. It is difficult to use for extensive, large, widely separated adhesions. *2: Diathermic:* This type of current has the advantage of not producing heat and smoke. Liberation is quicker and practically painless. The active electrode remains cold, but a very small intense arc is formed, under which separation of tissues occurs. The degree of dehydration is regulated by the voltage. Coagulation must occur prior to or simultaneously with the cutting. Both the Davis-Bovie and Matson instruments combine coagulation and cutting. Davidson's instrument has a coagulating diathermic electrode and a finer sectioning one. The absence of a cannula has some advantages. Chandler conceived the idea of a smaller combined diathermic thoracoscope. It has a large fixed coagulating electrode, and is small, but has an excellent field of vision at 30° duration. The electrode is in front of the lamp and easy to control and handle. The instrument can be sterilized by boiling. Chandler has also a combined instrument for direct vision and anaesthetization of adhesions. He uses Schranz's diathermy apparatus with fixed spark-gaps and only two switches. Matson uses a single flexible diathermic electrode, adjustable under thoracoscopic control, bendable to 90°, with different types of adaptable tips. He uses a special adjustable trocar, composed of a hollowed handle and a bakelite cannula. Most diathermic apparatus in use need preliminary coagulation. For the Davis-Bovie

there are three kinds of currents: (1) for superficial dehydration, (2) for coagulation, and (3) for cutting. *3: Combined:* Mandel, Kornitzer and Maurer combine galvanocauterization with diathermy. Chandler does this in the case of string adhesions, which are resistant and transmit the heat from diathermy, causing pain. Maurer's combined cautery is of irridium-platinum, and does not spark or cut, but coagulates a regular well-defined zone. He has made a transformer for both currents, worked by a foot-switch. Graf has a combined thoracoscope similar to a washing-out cystoscope. The mixed flexible cautery is moved by an Albarron lever and is inserted by a trocar with two sharp edges containing a spring which releases the knife after penetration of the chest-wall. Thoracocauterization is a very delicate operation; requiring much patience, technical knowledge and precision, to be confined to a few specialists.—*The Liberation of Intrapleural Adhesions with the Thoracoscope, O. M. Mistal, Tubercle, March, 1936, xvii, 256.*—(*A. P.*)

Phrenicoexairesis at Termination of Artificial Pneumothorax.—Phrenicoexairesis should not be applied indiscriminately to every case of artificial pneumothorax. In a a number of patients treated with a compressive type of pneumothorax, the lung remains shrunken and cicatrized and fails to reëxpand at the end-stage of treatment, leaving an empty pleural cavity to be filled by adjacent structures, primarily the mediastinum and its contents. A new train of symptoms often develops as a result of disturbance in the cardiovascular system, caused by extreme displacement and distortion of the mediastinal structures. To prevent extreme deviation of the mediastinum a high-tension pneumothorax may be maintained, oleothorax established, and thoracoplasty or phrenicoexairesis performed. The timely application of phrenic avulsion usually assures good results and is least disturbing to the patient. It is best done while there is still a free pleural space. The clinical and anatomical changes following phrenic avulsion at the termination of pneumothorax may be divided into three groups: cases in which the mediastinum and contents return to their former anatomical position with complete cessation of symptoms: cases in which there is only partial anatomical readjustment but symptomatic relief results; and cases in which there is only slight benefit and pneumothorax must be continued, but the interval between refills is greatly lengthened. Most of the cases fall into the first group.—*Phrenic Exeresis at the Termination of Pneumothorax Therapy, R. A. Bendove & L. R. Davidson, J. Thorac. Surg., June, 1936, v, 487.*—(*L. F. B.*)

Artificial Pneumothorax and Phrenic-Nerve Interruption.—An analysis of 78 cases in which pneumothorax and phrenic-nerve interruption was instituted coincidently was made in order to verify indications as proposed by various authors. X-ray evidence of closure of cavities was the sole criterion of success. Pneumothorax was induced first in 55 cases and was continued after phrenic surgery. Of these, there were 35 successes and 20 failures. Phrenic-nerve interruption was done first and pneumothorax established later in 23 cases, with 14 successes and 9 failures. There were, of 50 left-sided cases, 30 successes and 20 failures; and of 28 right-sided cases, 19 successes and 9 failures. There were, of 44 females, 27 successes and 17 failures; and of 34 males, 22 successes and 12 failures. The age varied from 12 to 53 years, with 49 patients between 21 and 35 years. The average rise of the diaphragm in the successful cases was 4.5 cm., and in the unsuccessful cases, 3.3 cm. Study of the unsuccessful cases suggests that too long a delay between the evident failure of pneumothorax and phrenic-nerve surgery may jeopardize chances for success. A trial period of 2 to 6 months is sufficient in most cases. If pneumothorax reveals a large upper-lung cavity diffusely adherent to the chest-wall, phrenic surgery will be unsuccessful, but the cavity may be reduced in size and the procedure may be justified in preparation for thoracoplasty. An apical cavity, with parenchymal tissue between it and a diffusely adherent pleura with pneumothorax pocket at the base, may be unaffected by phrenic surgery. Interruption of the phrenic nerve before resorting to positive pneumothorax pressures appears preferable. Study of the successful cases suggests that, if a cavity persists under pneumothorax in the absence of evident adhesions at the site of the cavity, phrenic-nerve interruption is in order. Cavities, held open by cord- or string-like adhesions, may be closed by phrenic surgery. Phrenic-nerve surgery and pneumothorax are complementary, and one often proves a valuable adjunct to the other. Less well-established observations are that, if a cavity is opposite the bulge in the presence of a mediastinal hernia, it will not be closed by phrenic surgery, but may be if it is above the level of the hernia. Frequent observations for return of motion must be made following temporary phrenic-nerve interruption. Rarely, successful attempts to establish pneumothorax may ensue after paralysis of the diaphragm, but unimpeded

collapse is rarely obtained. Temporary interruption of the phrenic nerve should be the general rule, thus giving the combined methods ample trial.—*Cavity Closure by Combined Pneumothorax and Phrenic Nerve Interruption, C. M. Miller, J. Thorac. Surg., June, 1936, v, 481.*—(*J. F. B.*)

Phrenicectomy Plus Artificial Pneumothorax.—Paralysis of the diaphragm eliminates one factor contributing to negative intrapleural pressures and contributes to more general rest of the lung. When the diaphragm rises high after paralysis the traction on adhesions between it and the visceral pleura is reduced, pulmonary tissue is relaxed and a hitherto ineffective pneumothorax may become effective. *Specific indications: 1: Pneumothorax a corda* is a partial pneumothorax, with the lung occupying the mesial part of the hemithorax in a cord-like manner, adherent both to the apical chest-wall and to the diaphragm. Under these conditions it is constantly pulled between two opposing forces during every inspiration, and attempts to increase collapse by higher intrapleural pressures are unavailing and may also displace the mediastinum. *2:* An uncollapsed lesion in the upper part of the lung adherent to the adjacent chest-wall, with the lower part adherent to the diaphragm by single or multiple adhesions. *3:* A basally situated chief lesion which remains uncollapsed, with either single or multiple diaphragmatic adhesions. When there is a question as to real symphysis, a preliminary hypertensive pneumothorax should be tried. *4:* When treatment is being abandoned, diaphragmatic paralysis should be considered, especially if there has been a pleural exudate. The fibrotic collapsed lung is incapable of filling the hemithorax without either undue strain on fibrosed parts or homolateral mediastinal displacement. However, a left-sided paralysis may be followed by undesirable gastric and cardiac symptoms. *5:* In all cases of complicating empyema.—*Some Indications for Paralysis of the Diaphragm in the Pneumothorax Treatment of Unilateral Pulmonary Tuberculosis, R. N. Tandon, Tubercle, February, 1936, xvii, 202.*—(*A. P.*)

Phrenicoexairesis.—Collapse therapy is based primarily on retraction and not on compression of the lung. During a series of studies it has been found that pressures of plus 15 to plus 20 at the end of refills have returned to neutral at the end of one hour. The mechanism of pneumothorax proceeds by stages: retraction, produced by reducing the negative pleural pressure; resulting relative functional rest, with venous and lymphatic stasis and anoxaemia; scar-tissue formation; collapse and disappearance of cavities as a result of bronchial stenosis; further retraction by increase of fibrosis. With phrenic-nerve avulsion, compression can be excluded. There are effects other than partial or complete functional rest following phrenicoexairesis. It has been shown that the phrenic nerve receives numerous sympathetic nerve fibres, from several ganglia, that enter the lung directly and share in its innervation, presiding over the pulmonary or bronchial vessels. A greater or less degree of congestion of the veins and capillaries of the lung, as well as desquamation of the alveolar epithelium, has been noted following phrenicectomy as well as after pneumothorax or thoracoplasty. These observations seem to indicate that the phrenic nerve takes a direct and active part in the innervation of the lung and, if it is interrupted, the lung undergoes certain definite circulatory changes. Aside from the function of gaseous exchange of the alveolar epithelium, could not its active and abundant desquamation impair the permeability of the alveoli and produce a greater degree of anoxaemia? That some factor is present, other than simple paralysis of the diaphragm, is evident on consideration of its combination with certain types of pneumothorax, especially those in which the lung is not adherent to the diaphragm. The lengthened interval between refills following phrenicectomy may be due not so much to a decreased pleural absorption of air but also to inability of the lung to reëxpand. Such a possibility would also lead to the hypothesis that an impairment of the tone of the smooth muscular system would render the already damaged bronchial walls more collapsible, and therefore an atelectasis more likely to occur. Pneumothorax is still the procedure of choice, but phrenic surgery proves very satisfactory in a good number of cases. Even a low percentage of cures should be enough to oblige us to give it a fair trial when pneumothorax has failed and before deciding upon thoracoplasty.—*Phrenicoexeresis, G. W. Weber, J. J. Jacobson & F. W. Holcomb, J. Thorac. Surg., June, 1936, v, 496.*—(*L. F. B.*)

Phrenicoexairesis.—There were 316 cases of phrenic evulsion at the Forster Green Hospital, Belfast, Ireland, between 1930 and 1934, with a few exceptions. Of 300 cases of definitely active pulmonary tuberculosis included, all showed tubercle bacilli in the sputum. The Felix type of operation was done on all, but search was also made for accessory nerves arising from the 5th cervical nerve, which were divided when found. Any nerve arising from the upper roots of the

cervical plexus, and running inward across the scalenus anticus muscle, was regarded as a possible accessory. There were no temporary crushings. A short transverse incision two fingers' breadth above the clavicle, either over its midpoint or over the scalenus anticus, was used in nearly all, with infiltration anaesthesia only of skin and subcutaneous tissue and blunt dissection to expose the nerve. The nerve was tested by pinching, which results in a quick jerk or contraction in the epigastric region. Ligature of vessels is rarely necessary. There were no untoward complications. *Phrenic evulsion with artificial pneumothorax:* In all cases the pneumothorax was done before the phrenic evulsion. There were 178 in all, in 87 of which the pneumothorax had previously been unsuccessful. Of these, collapse became satisfactory in 35 (3 also had adhesions cut). It was not found that refill intervals could be lengthened after phrenic evulsion, and positive pressures are useless, only combating the effects of phrenic paralysis. Two special indications are (1) presence of thin-walled cavities held out by adhesions, and (2) haemorrhage from a partially collapsed lung. In dealing with pleural adhesions, internal pneumonolysis is the method of choice, but there are often contraindications to this and phrenic evulsion is a useful interim procedure. In 21 of 33 cases in which the adhesions were limited in extent, a satisfactory collapse was obtained, and in 13 of 40 with adhesions in two out of 3 zones. *Independent phrenic evulsion:* Of 96 cases (out of 122) in which satisfactory comparative X-ray films were obtained, 35 had diffuse disease in all areas. Of the remaining 61, 57 per cent showed well-marked contraction of the diseased area of a more or less selective character. In 17 per cent the reverse was true (contraselective contraction), and in 26 per cent results were indefinite. Of 35 patients with contraction of the diseased area, 25 had disease of the upper half of the lung and so had all of the 10 patients responding unfavorably. Thus, altogether, patients with basal lesions did better. The effects of this procedure were studied on 66 single cavities. One-third of these healed after the operation, nearly all being early and small, and a little more than one-third improved; a small number (8) became worse, and the others remained the same. The results of treatment were determined in 161 cases, reduced to 106 if those satisfactorily collapsed by pneumothorax are omitted, and of these 71 were known to be living. A somewhat better idea of results is obtained from a comparison of those cases with and without phrenic evulsion, more being dead than alive in the latter group. The diaphragm was successfully paralyzed in 99 per cent of cases. The results were satisfactory in an artificial-pneumothorax group in which complete reëxpansion was inadvisable. Unsatisfactory collapse by pneumothorax was made satisfactory in 37 per cent of cases. The usual result is contraction of diseased lung tissue, but occasionally the reverse occurs. Phrenic evulsion is less successful in upper-zone than in midzone or basal lesions. Only one of 22 cases of multiple cavity showed healing.—*The Treatment of Pulmonary Tuberculosis by Phrenic Evulsion, G. R. B. Purce & B. R. Clark, British J. Tuberc., January, 1936, xxx, 9.*—(*A. P.*)

Gastric Dilatation Following Left Phrenic Paralysis and Thoracoplasty.—Four cases are reported of acute dilatation of the stomach following left-sided thoracoplasty, in which the left hemidiaphragm had been previously paralyzed. In one case there was marked elevation of the diaphragm before thoracoplasty, and in three the rise was not marked. All the patients showed marked dyspnoea, cyanosis and tachycardia, with accompanying abdominal distention. Two of the patients died, the condition being recognized at autopsy. In the other two patients rapid relief and recovery resulted from the use of continuous suction through a nasal catheter as employed by Wangensteen in the treatment of intestinal obstruction.—*Acute Dilatation of the Stomach Following Left-sided Phrenic Paralysis and Thoracoplasty, C. A. Thomas & F. R. Harper, J. Thorac. Surg., June, 1936, v, 507.*—(*L. F. B.*)

Anterolateral Thoracoplasty Plus Phrenicectomy.—This, essentially a phrenicoexairesis combined with the removal of variable lengths of ribs along the line of maximum movement, is being perfected by Ascoli. The patient previously undergoes careful thoracometry and respiratory and circulatory functional tests. Local anaesthesia with novocaine plus intercostal nerve-blocking are used with very little general anaesthesia. The rule is to remove as much of the 1st rib as possible, 10 to 12 cm. of the 2nd and 3rd, and 6 to 8 cm. of the next four up to the 8th. When there is hope of a phrenic interruption alone being sufficient, it is done and the results watched a few weeks. Otherwise, the thoracoplasty is done at once, in a single stage if the general condition is good. The "Roman School" holds that basal dissemination of disease is less likely with a paralyzed diaphragm, and prefers to do the lower ribs before the upper, doing the second stage after about a week.

In doing the first rib, sharp instruments should be avoided and in some cases an extrapleural apicolysis or scaleniotomy may be substituted. The lengths of rib removed vary in individual cases. Retarding of regeneration is advisable, cutting as much periosteum as possible away and plugging the rib-beds with gauze soaked in 10 per cent formalin. *Results:* Of 71 cases operated on at the Benito Mussolini Institute at Rome up to July, 1934, only one died directly from operation. Forty-one cases are analyzed, the others being too recent. In 56 per cent of these, positive sputum became negative and 80 per cent of those previously febrile became afebrile. Among immediate results is reduction in size of cavities, and in 26 out of 41 cases they entirely disappeared eventually. It is admitted that, in long-standing large cavities with rigid walls and in chronic empyema with unexpansible lung, "retraction thoracoplasty" may fail and the more radical compression of the Sauerbruch type be necessary. Roentgenographic observations are valuable in determining this. But the contraindications are fewer and the operative trauma and shock less. Respiratory function is less disturbed and deformity less.—*Anterolateral Thoracoplasty in Pulmonary Tuberculosis, J. Thevarthundil, Tubercle, January, 1936, xvii, 152.*—(*A. P.*)

Thoracoplasty.—The effects of thoracoplasty are not comparable to those of complete artificial pneumothorax, which is both more efficient and less dangerous. It is a mistake to urge immediate thoracoplasty for large apical cavities, even if near the surface, for, provided pressures are kept low, there is little danger of rupture. Even unsuccessful partial pneumothorax will protect against aspiration spread during upper-stage thoracoplasty and can later be discontinued. Thoracoplasty is seldom successful in a patient with poor resistance. Resistance is evidenced by fibrosis and is usually contraindicated if fibrosis is absent. It is indicated especially when there are chronic fibrocaseous lesions, with cavitation, when rest and pneumothorax have failed, the latter usually because of adhesions. Although thoracoplasty allows retraction in the presence of adhesions, it does not always result in cavity closure. In some cases a weak mediastinum yields before the cavities do; in such cases, a supplementary anterolateral operation is often required. The activity of contralateral lesions is determined by observation with serial X-rays. Even if a lesion is quiescent, its location and extent are important. More than a quarter of the lung should usually exclude operation. Small apical cavities are permissible, but cavitation below the apex is definitely a contraindication. An unsuitable case may be rendered suitable by prolonged bed-rest. Thoracoplasty is never a surgical emergency procedure. If a lesion develops pending observation it is pretty certain the case was unsuitable from the first. Sudden exacerbations in healthy lung tissue are disheartening. The history is here the best clue, especially if lesions have previously cleared without fibrosis. Age and general condition are important. Generally, those under 20 and over 55 are unsuitable. In the adolescent type, "flare-ups" are especially common, and, in the late middle-aged, recuperative powers decline and the myocardium is often unhealthy. Long-standing disease, if afebrile, is no contraindication, but prolonged toxaemia worsens the outlook. Active disease in other organs, except the larynx, usually excludes thoracoplasty. Bronchitic cases must be approached with caution. The choice of the correct time to operate is important. When the limit of improvement by other means is reached, operation should not be delayed and delay is psychologically undesirable once decision is made. A skillful anaesthetist is of great value; likewise, after-care. The weather deserves some consideration. In England, Young prefers to avoid recommending operation between November and March when respiratory infections prevail. A patient with thoracoplasty is crippled more or less. The mortality is not negligible, and some cases become physical and mental wrecks. Thoracoplasty represents the last stage in the active treatment of pulmonary tuberculosis. An error made can never be repaired, and in no form of treatment is skilled collaboration between physician and surgeon more essential.—*Thorocoplasty in the Treatment of Pulmonary Tuberculosis, F. H. Young, Brit. M. J., April 4, 1936, no. 3926, 683.*—(*A. P.*)

Anterior Thoracoplasty.—Anterior thoracoplasty may be indicated to reduce operative mortality and morbidity, close cavities, and obtain better selective collapse of the upper portion of the lung. In patients judged to be inferior risks, thoracoplasty should be staged in a horizontal as well as a vertical direction. Indications for dividing rib-resection into a posterolateral and anterior stage are large amounts of sputum, especially if raised with difficulty, retraction of the mediastinum and kinking of the trachea, preoperative dyspnoea, and excessive paradoxical motion observed during the first posterolateral stage. In cases in which maximum collapse is desired and not obtained by posterolateral rib-resection, an anterior stage is indicated, and may be pro-

ceeded with before stiffening of the decostalized part of the thoracic wall has occurred. In lesions limited to the upper third of the lung, maximum selective collapse may be obtained with preservation of greater degree of function of the nondiseased lower lung, making phrenic-nerve interruption unnecessary or inadvisable. The technique consists of resection of the anterior costal stumps and parasternal division of the costal cartilages. Division of the cartilages allows them to hinge at the sternum, and swing mesially and posteriorly. This is applied to the 2nd and 3rd, and rarely the 4th ribs, the 1st having been more easily completely removed at the upper posterior stage. The optimal time to perform an anterior stage is after posterior resection of enough ribs has been done to allow the scapula to fall forward. Anterior thoracoplasty has been used for 50 of 141 cases operated upon between December, 1932, and October, 1935. In 19 of the 50 cases, cavities of 5 cm., or even more, were present. In the remainder a single cavity of less than 5 cm. or multiple cavities were present. The largest cavity measured was 11.3 by 8 cm. Each of the 50 cases had positive sputum. Closure of cavities and negative sputum resulted in 46 cases. There was no operative mortality and no late mortality due to tuberculosis. The condition of the 4 cases with positive sputum was improved.—*Complementary Anterior Thoracoplasty for Pulmonary Tuberculosis, C. Haight, J. Thorac. Surg., June, 1936, v, 453.*—(*L. F. B.*)

Apical Thoracoplasty.—The increasing use and popularity of upper partial thoracoplasty in the treatment of tuberculous cavities has led to further developments in this operation as a specialized procedure. The operation has usually been an exaggerated form of the upper stage of the Sauerbruch paravertebral operation, with resection of considerable lengths of the upper 4 or 5 ribs overlying the diseased area. The main part of the collapse is in the transverse rather than the vertical axis. This type of operation often fails when the cavity is centrally placed or close to the mediastinum, when it may persist as a pear-shaped slit with its long axis vertically placed. It then remains as an open source of infection, and a supplementary anterolateral operation becomes necessary. Collapse by apical thoracoplasty may be facilitated by an extrapleural stripping operation, carrying dissection posteriorly into the paravertebral gutter and upward over the apical dome, allowing fascial and muscle bundles to add their weight to collapsing lung. This "extrafascial apicolysis" is definitely superior to that produced by the standard operation but cavities near the mediastinum are not always collapsed. Recent experience indicates that the danger of stripping the pleura from the mediastinum is negligible, and it was decided to strip the whole diseased area over the apex and also to perform extensive resection of upper ribs—Gravesen's "cupolaplasty." A necessary requirement is fusion of the pleural membranes over the area to be collapsed and usually pneumothorax will have been unsuccessfully attempted or abandoned. The operation begins as an upper thoracoplasty. The muscles attached to the vertebral border of the scapula are divided and the latter lifted off the chest-wall, exposing the upper ribs. Long lengths of the first three ribs are removed, including the periosteum of the 3rd and possibly of the 2nd, that of the 1st being thoroughly stripped. Dissection is carried out in the plane of the endothoracic fascia within the bony framework until the whole apex is freed, when it drops to a marked degree and can be held down with a swab during further dissection. If necessary, the whole of the upper two ribs can be safely removed. Below this the degree of resection is graded according to the degree of collapse required. This grading prevents the leaving of a sharp shelf below the site of operation. Drainage for a few days is necessary. To overcome the tendency of the stripped apex to reëxpand, the intercostal periosteomuscular bundles may be divided either anteriorly or posteriorly, and sutured to each other and the inner aspect of the thoracic cage at a lower level to form a closed grid above the depressed apex. There is little more shock than is caused by a rib resection of the same magnitude, although there is more immediate postoperative reaction, especially as to temperature, pulse and sputum. Pain and deformity are not conspicuous. Infection of the dead space occurred only in cases not drained, and it was not serious. X-rays taken shortly after operation show a collection of fluid above a lung apex often depressed to the level of the hilum. As this is absorbed, the upper lung border rises somewhat. In the case of firm-walled apical cavities the degree of collapse is superior to that obtainable by any other procedure except extrapleural pneumonolysis and wax plombage, which is often extruded. The method is that of choice in cases of localized apical disease with cavitation.—*Apical Thoracoplasty with a Description of Recent Modifications in Technique, W. H. Romanis & T. H. Sellors, Lancet, March 28, 1936, ccxxx, 714.*—(*A. P.*)

Bronchography Following Thoracoplasty.—The use of lipiodol is recommended

as helpful in making a more accurate evaluation of the results from thoracoplasty. Twenty cubic centimetres of oil were introduced. After films were taken the patient was instructed to cough up all the oil possible. In only one of 20 cases was there minimal evidence of iodism.—*Bronchography, H. L. Cabitt, J. J. Singer & E. A. Graham, J. Thorac. Surg., February, 1936, v, 259.*—(*L. F. B.*)

Surgical Revision of Unsatisfactory Thoracoplasty.—The ideal thoracoplasty should produce a complete mechanical closure of cavity or empyema pocket and be followed by the permanent disappearance of all symptoms. Various causes of unsatisfactory thoracoplasty, listed in order of frequency, are huge cavity, insufficient rib-resection, partial thoracoplasty, too long delay between stages, continued excavation, rigidity of chest-wall and pleura, rigidity of lung, inefficient compression, and inadequate postoperative treatment. The actual procedure necessary must be determined in each individual case by local conditions present, size and location of the cavity, and the type of thoracoplasty performed at the original operation. Simply expressed, this means a complete deribbing of the chest overlying the cavity, extending well above and below the involved area to permit more adequate collapse. The whole procedure is necessarily a tedious one, and care must be exercised in removing the irregular regenerated bone to avoid injury to the underlying pleura or lung. In several instances, because of the patient's condition or the extensive nature of the operation, the procedure has been done in more than one stage. If X-ray examination, using the Bucky-Potter diaphragm, after operation reveals the cavity uncollapsed, the incision is opened within two weeks, if the condition of the patient permits, and more regenerated rib removed or an extraperiosteal pack inserted, or both. The serratus anterior muscle has been used as a pack in three cases with good results, but its use is not favored because it affords a soft pack of limited size that will later atrophy and produces a wing scapula. For the past two years, 15 to 30 square feet of gauze saturated with 1:1000 solution of neutral acriflavine has been used. This is applied in the operative field in the plane between the intercostal muscle and periosteum medially and the serratus anterior muscle and scapula laterally. The pack is allowed to remain from 28 to 48 days. Following removal of the pack the wound is left open until clean granulation tissue appears; then external pressure is applied, obliterating the depths of the wound. Complete healing requires several months and may be hastened by secondary plastic closure. Of 40 patients, 23 had reoperation alone; 1, reoperation and external pneumolysis; 3, reoperation and a muscle pack; and 13, reoperation and subscapular gauze pack. Of the group, 25 have obtained closure of cavity and 31 have negative sputum. The use of a gauze pack has given consistently better results than reoperation alone and there has been no mortality due to its use.—*Surgical Revision of Unsatisfactory Thoracoplasty by Reoperation and Extraperiosteal (Subscapular) Packing, T. J. Kinsella, J. Thorac. Surg., February, 1936, v, 267.*—(*L. F. B.*)

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